United States Department of the Interior
NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

August 4, 2009

N3615 (2350)

David A. Finley, Administrator
Division of Air Quality
Department of Environmental Quality
122 W. 25th Street
Cheyenne, Wyoming 82002

Dear Mr. Finley:

Thank you for providing this opportunity to comment upon the Wyoming Department of Environmental Quality's (WY DEQ's) proposal for Best Available Retrofit Technology (BART) for the 13 Electric Generating Units (EGUs) in Wyoming that are subject to BART. We are impressed with the effort and expertise that went into this effort, and we are pleased that WY DEQ is proposing major reductions in the visibility-impairing pollutants nitrogen oxides (NO_x) and particulate matter (PM_{10}). However, we believe that additional reductions can be achieved under the BART program. Based on our analyses summarized below and discussed in detail in the enclosed documents, we believe that selective catalytic reduction (SCR) controls are BART for additional EGUs beyond those identified by WY DEQ. Our comments below address the five-step BART process described by EPA's BART Guidelines and documented by WY DEQ. We first discuss NO_x controls, then PM_{10}. Sulfur dioxide (SO_2) controls have already been addressed by WY under the 309 State Implementation Plan and are discussed briefly at the end of our comments.

NO_X Step 1: IDENTIFY AVAILABLE RETROFIT CONTROL TECHNOLOGIES
Except for Basin Electric's analysis for Laramie River, all of the other (PacifiCorp) analyses included a reasonable suite of options. Basin has omitted the most-effective NO_x control technology, the combination of Low-NO_x Burners (LNB) plus Over-Fire Air (OFA) plus SCR. It is generally accepted that, although installation of combustion controls ahead of SCR will increase the capital cost of the system, the reduction in operating costs will more than offset that initial increase in capital cost. Virtually every new or retrofit SCR system includes combustion controls. Without this combination of technologies, Basin's cost analysis is fundamentally flawed.

NO_X Step 2: ELIMINATE TECHNICALLY INFEASIBLE OPTIONS
This step was handled appropriately.

NO_X Step 3: EVALUATE EFFECTIVENESS OF REMAINING CONTROL TECHNOLOGIES
The ability of SCR to reduce emissions was consistently underestimated. For example, for the LNB/OFA+SCR option, PacifiCorp, Basin Electric, and WY DEQ assumed 0.07 lb/mmBtu for all averaging periods. However, WY DEQ has issued permits for new EGUs requiring that they meet 0.05 lb/mmBtu over averaging periods of 24-hours[1] and 30-days.[2] Furthermore, EPA's Clean Air Markets (CAM) data (Appendix A) and vendor guarantees show that SCR can typically meet 0.05 lb/mmBtu (or lower) on an annual average basis. PacifiCorp, Basin Electric, and WY DEQ have not provided any documentation or justification to support the higher values used in their analyses. Our review of operating data (Appendix A) suggests that a NO_X limit of 0.06 lb/mmBtu is appropriate (with an adequate "safety-margin") for LNB/OFA+SCR for a 30-day rolling average, and 0.07 lb/mmBtu for a 24-hour limit and for modeling purposes, but a lower rate (e.g., 0.05 lb/mmBtu or lower) should be used for annual average and annual cost estimates. When the annual NO_x reductions are underestimated, the cost-effectiveness of the control option is negatively affected.

NO_X Step 4: EVALUATE IMPACTS AND DOCUMENT RESULTS
The cost of SCR was consistently overestimated. EPA's BART Guidelines recommend use of the OAQPS Control Cost Manual. Neither PacifiCorp, Basin Electric, nor WY DEQ provided justification or documentation for their cost estimates. We were not provided with any vendor estimates or bids, and PacifiCorp, Basin Electric and WY DEQ did not use the recommended Control Cost Manual. This resulted in much-higher SCR costs than suggested by available literature (see Appendix C cost summaries) which shows SCR costs ranging from $50 - $267/kW.

Our greatest concern with the cost analyses presented by WY DEQ is the over-emphasis on the incremental costs resulting from addition of SCR to new combustion controls. Incremental costs are an appropriate consideration, but they should not become the sole basis for a BART decision. We would like to see WY DEQ also consider the average costs calculated for combustion controls plus SCR.

As recommended by the BART Guidelines, we applied the OAQPS Control Cost Manual to the EGUs and derived costs that fell within the Appendix C cost-survey range. As illustrated in Table 1 (and the relevant workbooks in Appendix C) our calculated SCR costs for WY EGU are below $2000/ton at all units. As a result, we believe that capital and annual costs are overestimated by PacifiCorp, Basin Electric, and WY DEQ.

The basis for equipment cost estimates should be documented, either with data supplied by an equipment vendor (i.e., budget estimates or bids) or by a referenced source (such as the OAQPS Control Cost Manual, Fifth Edition, February 1996, 453/B-96-001). In order

[1] Basin Electric—Dry Fork
[2] WYGEN3

to maintain and improve consistency, cost estimates should be based on the OAQPS Control Cost Manual, where possible. The Control Cost Manual addresses most control technologies in sufficient detail for a BART analysis. The cost analysis should also take into account any site-specific design or other conditions identified above that affect the cost of a particular BART technology option.

EPA's belief that the Control Cost Manual should be the primary source for developing cost analyses that are transparent and consistent across the nation and provide a common means for assessing costs is further supported by this November 7, 2007, statement from EPA Region 8 to the North Dakota Department of Health:

> The SO_2 and PM cost analyses were completed using the CUECost model. According to the BART Guidelines, in order to maintain and improve consistency, cost estimates should be based on the OAQPS Control Cost Manual. Therefore, these analyses should be revised to adhere to the Cost Manual methodology.

According to WY DEQ, "PacifiCorp used the EPA Air Pollution Control Cost Manual, which is identified in 40 CFR part 51 Appendix Y(IV)(D)(4)(a)(5) as a reference source, to estimate capital costs and calculate cost effectiveness." This statement is misleading because, according to PacifiCorp, "Costs and schedules for the LNBs and OFA, SNCR, and SCR were furnished to CH2M HILL by PacifiCorp, developed using S&L's **internal proprietary database**, and supplemented (as needed) by vendor-obtained price quotes."

WY DEQ goes on to state that, "Beginning on page 2-28 of Chapter 2.5.4.2, the manual discusses retrofit cost consideration including the practice of developing a retrofit factor to account for unanticipated additional costs of installation not directly related to the capital cost of the controls themselves. However, PacifiCorp did not present a retrofit factor in their cost analyses." If PacifiCorp had actually used the EPA Control Cost Manual Section 4.2 on SCR, the retrofit issue would have been explicitly and transparently accommodated by that approach. Instead, PacifiCorp provides insufficient information to determine if and how it addressed this issue.

WY DEQ's statement that Basin used the EPA Air Pollution Control Cost Manual (Control Cost Manual) is misleading in the context of Basin's estimation of costs for SCR. Instead, Basin appears in Attachment 1 to its July 2008 re-submittal to have used a format similar to that found in several sections of the Control Cost Manual, but completely different from Section 4.2 of the Manual which deals specifically with estimating costs for SCR.

NO_X Step 5: VISIBILITY IMPROVEMENT DETERMINATION

We believe that it is appropriate to consider both the degree of visibility improvement in a given Class I area as well as the cumulative effects of improving visibility across all of the Class I areas affected. While we agree with WY DEQ's assessment that the modeling analyses likely captured the greatest impacts, we typically request that all Class I areas within 300 km of the source be included in the modeling analysis. WY DEQ addressed visibility impacts in a partially-cumulative analysis of some multiple Class I areas, however it did not typically include all of the Class I areas within 300 km. In addition to Bridger Wilderness Area (WA), Fitzpatrick WA, and Mount Zirkel WA, we request that

WY DEQ also consider impacts at Grand Teton National Park (NP), Yellowstone NP, Rocky Mountain NP, Washakie WA, Teton WA, Flat Tops WA, Rawah WA, and Eagles Nest WA.

As illustrated in Table 1, considering just the incremental benefits of SCR at Jim Bridger Units 1 and 3, calculated for 3 Class I areas, the deciview (dv) improvement would be 0.6 dv. Comparing the benefits of SCR combined with combustion controls to the current baseline without controls yields a 1.7 dv improvement. We believe the latter benefit is the appropriate basis for evaluating the benefits of BART controls at Bridger Units 1 and 3.

In evaluating the benefits of BART controls, it does not make sense to use the same metric to evaluate the effects of reducing emissions from a BART source that impacts only one Class I area as for a BART source that impacts multiple Class I areas. And, it does not make sense to evaluate impacts at one Class I area, while ignoring others that are similarly significantly impaired. If we look at only the most-impacted Class I area, we ignore that the other Class I areas are all suffering from impairment to visibility caused or contributed to by the BART source. It follows that, if emissions from the BART source are reduced, the benefits will be spread well beyond only the most-impacted Class I area, and this should be accounted for.

Our greatest concern with the visibility analyses presented by WY DEQ is the total emphasis on the incremental improvements to visibility resulting from SCR—it calculated only the incremental improvement in visibility resulting from addition of SCR to the proposed combustion controls. Although incremental benefits are an appropriate consideration, they should not become the sole basis for a BART decision. WY DEQ should have presented the total visibility improvement that would result from a combination of control options instead of presenting only the incremental improvement.

We have an additional concern with the emissions modeled by PacifiCorp and WY DEQ as presented in the "Post-Control Scenario A" and "Post-Control Scenario B" columns of WY DEQ's related tables. For example, in the Jim Bridger Table 27, sulfuric acid mist (H_2SO_4) emissions are estimated to increase from 55.2 lb/hr under Scenario A to 94.7 lb/hr under Scenario B. Although no explanation is provided, we assume that the increase in H_2SO_4 is due to the oxidation of SO_2 to SO_3 and on to H_2SO_4 in the flue gas. Because an increase in primary sulfate may adversely impact visibility and reduce the estimated benefits of adding SCR, we are providing information in the enclosed documents relating to the estimation of H_2SO_4 emissions and request that WY DEQ evaluate and explain this issue as it pertains to all of the PacifiCorp BART analyses.

BART CONCLUSIONS FOR NO_x CONTROLS

WY DEQ's conclusions and rationales were clearly stated, but sometimes lacked a basis by which the reader could understand the conclusion.

NPS recommends that $/dv be used as an additional metric for evaluating BART controls. In Table 1, using the EPA Control Cost Manual and dv improvement for combustion controls plus SCR, we calculate $/dv benefits for the WY EGUs in the range of $1.1 to 8.7 Million/dv. These benefits are calculated for just the three nearest Class I areas and would be greater if benefits for the additional impacted Class I areas within 300 km of these facilities had been considered. Nonetheless, the benefits are well within the range that has been identified as reasonable for BART controls in other states.[3] From these data, we conclude that SCR controls are reasonable BART controls for the WY EGUs.

Our concerns with WY's BART conclusions are further documented below:

According to WY DEQ, "Several different metrics can be considered when evaluating the cost-benefit relationships of different emission control technologies. In 40 CFR part 51 Appendix Y two metrics are specifically mentioned: cost effectiveness and incremental cost effectiveness. Through the application of BACT, the Division has extensive experience using cost effectiveness (i.e., dollars per ton of pollutant removed) to evaluate different control technologies. Incremental cost effectiveness is also used extensively by the Division when comparing emission controls under the BACT process. While the BART and the BACT processes are not necessarily equivalent, control determinations from either process are based on cost effectiveness and incremental cost effectiveness and are indicative of the economic costs to control emissions. In addition to providing cost effectiveness and incremental cost effectiveness results, PacifiCorp provided cost information in terms of cost of applying emission controls and the level of visibility improvement achieved (i.e., dollars per deciviews). While this metric can illustrate the control cost and visibility improvement differences between control options, it is not commonly used to assess the overall effectiveness of pollution control equipment. When performing the presumptive BART limits analyses for NO_X and SO_2, EPA addressed cost effectiveness and incremental cost effectiveness separate from visibility improvement. EPA did not use the dollars per deciview metric to compare control options. Visibility improvements from the application of the analyzed control measures used to establish presumptive levels were addressed in a separate visibility analysis...the Division evaluated the amount of anticipated visibility improvement gained by the application of additional emission control technology. The Division considered capital cost, annual cost, cost effectiveness, and incremental cost effectiveness in the evaluation of each proposed NO_X emission control."

NPS: While we recognize the expertise of WY DEQ in its use of average and incremental cost-effectiveness in conducting its BACT analyses, WY DEQ should provide the benchmarks it used to determine if the average or incremental cost of a given control option was "reasonable." Furthermore, we believe that WY DEQ has not given enough consideration to the core purpose of the BART program, which is to improve visibility in our Class I areas. BART is not necessarily the most cost-effective solution

[3] http://www.wrapair.org/forums/ssjf/bart.html

but instead, BART represents a broad consideration of technical, economic, energy, and environmental (including visibility improvement) factors.

We agree that dollars per deciview (dV) "is not commonly used to assess the overall effectiveness of pollution control equipment" in the BACT context. However, EPA did explicitly suggest cost/dV in its BART Guidelines[4] and it is becoming common in the BART program and has been cited either by a state or by a BART source in at least 18 reviews.[5] Furthermore, both PacifiCorp and Basin Electric apparently considered cost/dV a useful metric when they made statements in their BART proposals indicating that costs of millions of dollars per deciview were reasonable.

Compared to the typical control cost analysis in which estimates fall into the range of $1,000 - $10,000 per ton of pollutant removed, spending millions of dollars per deciview (dV) to improve visibility may appear extraordinarily expensive. However, our compilation[6] of BART analyses across the U.S. reveals that the **average cost per dV proposed by either a state or a BART source is $10 - $17 million**,[7] with a maximum of almost $50 million per dV proposed by Colorado at the Martin Drake power plant in Colorado Springs.

While it is appropriate to consider incremental costs in addition to average costs, we have a concern with the over-emphasis placed by WY DEQ upon this factor and with the way in which the incremental cost analysis was conducted.[8] When rejecting SCR, WY DEQ consistently stated that "the cost of compliance for installing SCR on each unit is significantly higher than [combustion controls]." It is generally understood that the cost/ton of pollution control is an exponential function with an increasing slope as higher control efficiencies are approached. Thus, the incremental cost of moving from lower control to higher control will increase as higher control efficiencies are sought. Addition of SCR is always going to be "significantly higher" than combustion controls. If WY DEQ were to apply this reasoning to its Best Available Control Technology (BACT) analyses, it would never require any controls more stringent than low-sulfur fuels,

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[4] E. How do I select the "best" alternative, using the results of Steps 1 through 5?
1. Summary of the Impacts Analysis
From the alternatives you evaluated in Step 3, we recommend you develop a chart (or charts) displaying for each of the alternatives:
(4) costs of compliance -- total annualized costs ($), cost effectiveness ($/ton), and incremental cost effectiveness ($/ton), and/or any other cost effectiveness measures (such as **$/deciview**);

[5] Benning Road (PES), Boardman (OR), Bridger (PacifiCorp), Ft. Churchill (NVE), Four Corners (APS), Gardner (NVE), Gerald Gentleman (NPPD), Healy (AK), Johnston (PacifiCorp), Laramie River (Basin), Naughton (PacifiCorp), Navajo (SRP), O-N Minerals (VA), San Juan (PSNM), Sherburne County (Xcel), Tracy (NVE), TriGen (CNEC) Wyodak (PacifiCorp)

[6] http://www.wrapair.org/forums/ssjf/bart.html

[7] For example, PacifiCorp has stated in its BART analysis for its Bridger Unit #2 that "The incremental cost effectiveness for Scenario 1 compared with the baseline for the Bridger WA, for example, is reasonable at $580,000 per day and $18.5 million per deciview."

[8] EPA BART Guideline: "You should consider the incremental cost effectiveness in combination with the average cost effectiveness when considering whether to eliminate a control option."... "You should exercise caution not to misuse these [average and incremental cost effectiveness] techniques... [but consider them in situations where an option shows]...slightly greater emission reductions..."

multiple cyclones, and combustion controls. Instead, we have observed that WY DEQ has been very successful in requiring that new sources install both combustion controls and SCR under its BACT program at very low limits. We suggest that the combination of combustion controls plus SCR should instead be viewed as a package of complementary parts, and that WY DEQ should determine if addition of SCR is unusually expensive at a specific BART source compared to other installations. Our analysis shows that both the total cost and the incremental cost of SCR is less expensive at the EGUs evaluated by WY DEQ than the $10 million - $17 million average cost per deciview proposed and/or accepted as BART by the sources and/or states referenced above.

Because, in most cases, the cost of pollution control rises exponentially with control efficiency, the slope of the cost-versus-efficiency curve will also increase. For this reason, rigid use of incremental cost effectiveness will always result in the choice of the cheapest option if carried to this extent. According to the NSR Workshop manual, "As a precaution, the difference in incremental costs among dominant alternatives cannot be used by itself to argue one dominant alternative is preferred to another." Instead, it should be used to compare closely performing options.

In most cases,[9] WY DEQ determined that both the average and incremental costs were "reasonable," but still rejected the option as BART. WY DEQ should explain the rationale for such decisions.

Additional reasons given by WY DEQ for rejecting SCR include:

WY DEQ: Additional non-air quality environmental mitigation is required for the use of chemical reagents.
NPS: We are aware of at least three permits[10] issued by WY DEQ requiring application of SCR to new sources and wonder why this issue is raised in these particular cases.
WY DEQ: Operation of LNB with separated OFA and SCR is parasitic and requires... power from each unit.
NPS: the cost of this demand has been correctly included in the cost analyses and should not be double-counted unless that parasitic demand would result in a power shortage.

PacifiCorp and WY DEQ also state that installation of SCR could:

- impact the salability and disposal of fly ash due to higher ammonia levels. **NPS**—PacifiCorp and WY DEQ should present evidence that this is actually true, and quantify the economic impact.
- potentially create a visible stack plume sometimes referred to as a blue plume, if the ammonia injection rate is not well controlled. **NPS**—We assume that PacifiCorp has the capability to control the ammonia injection rate properly.
- potentially create other environmental impacts involving the transportation of the ammonia to, and the storage of ammonia at the power plant site, especially if anhydrous ammonia is used. **NPS**—We recognize these risks, but note that SCR has been in use at many facilities for many years with minimal actual problems if

[9] Bridger #1 - #4 for NO_x, Naughton #1 - #3 for NO_x, Wyodak for NO_x,
[10] WYGEN 2 & 3 and Basin Electric Dry Fork.

properly addressed by the operating company. We also note that WY DEQ has required installation and operation of SCR at other facilities.

WY DEQ notes that "PacifiCorp estimated that the installation of SCR requires a minimum of 6 years of advanced planning and engineering before the control can be successfully installed and operated." Considering that Minnesota Power supplied a construction schedule[11] to install SCR plus a new scrubber, fabric filter, and chimney at its 330 MW Boswell Unit #3 in just over half the time proposed by PacifiCorp, PacifiCorp should explain why so much extra time is needed.

PM_{10} BART CONTROLS

Our only significant and consistent concern with WY DEQ's BART proposals for PM_{10} relates to **PM_{10} Step 3: EVALUATE EFFECTIVENESS OF REMAINING CONTROL TECHNOLOGIES.** Considering that WY DEQ has issued at least three permits[12] for new EGUs with fabric filters limited to 0.012 lb/mmBtu, WY DEQ should explain why the equivalent BART options cannot achieve the same limit, or the 0.010 lb/mmBtu limit permitted by EPA for the Desert Rock power plant.

Our concern is further illustrated by WY DEQ's decision that, while it considers the cost of the installation of fabric filters proposed by PacifiCorp to be unreasonable, it has determined that fabric filter control strategy is BART for those EGUs:

> While the Division considers the cost of compliance for a full-scale fabric filter on Unit 3 not reasonable, PacifiCorp is committed to installing this control device and has permitted the installation of a full-scale fabric filter on Unit 3 in a recently issued New Source Review construction permit. A full-scale fabric filter is the most stringent PM/PM_{10} control technology and therefore the Division will accept it as BART. Naughton Unit 3: Installing a new full-scale fabric filter and meeting PM/PM_{10} emission limits of 0.015 lb/mmBtu, 56 lb/hr, and 243 tpy as BART for PM/PM_{10}.

We believe that it is highly unlikely that PacifiCorp would propose a BART strategy unless it finds the strategy to be reasonable or is otherwise compelled to do so. WY DEQ should either accept that addition of fabric filtration is a reasonable BART alternative in the context of providing addition PM_{10} reductions and the costs that go with those reductions, or state what it considers reasonable average and incremental costs for PM_{10} control to be.

Our calculations of PM_{10} BART control costs are further illustrated in Table 2.

SO_2: REGIONAL SO_2 MILESTONE AND BACKSTOP TRADING PROGRAM

PacifiCorp evaluated SO_2 control technologies that can achieve a SO_2 emission rate of 0.15 lb/mmBtu or lower from the coal-fired boilers. PacifiCorp's proposed BART controls are upgrading the existing wet FGD on each of the units. Wyoming is a §309 state participating in the Regional SO_2 Milestone and Backstop Trading Program. §308(e)(2) provides States with the option to implement or require participation in an

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[11] See Appendix B

[12] WYGEN2, WYGEN3, Basin Electric—Dry Fork

emissions trading program or other alternative measure rather than to require sources subject to BART to install, operate, and maintain additional control technology to meet an established emission limit on a continuous basis. However, the alternate program must achieve greater reasonable progress than would be accomplished by installing BART. A demonstration that the alternate program can achieve greater reasonable progress is prescribed by §308(e)(2)(i). Since the pollutant of concern is SO_2, this demonstration has been performed under §309 as part of the state implementation plan. §309(d)(4)(i) requires that the SO_2 milestones established under the plan "...must be shown to provide for greater reasonable progress than would be achieved by application of BART pursuant to §51.308(e)(2)." Wyoming participated in creating a detailed report entitled **Demonstration that the SO_2 Milestones Provide Greater Reasonable Progress than BART** covering SO_2 emissions from all states participating in the Regional SO_2 Milestone and Backstop Trading Program. The document was submitted to EPA in support of the §309 Wyoming Regional Haze SIP in November of 2008. NPS will work with Wyoming, the other §309 participating States, and EPA regarding any issues raised by EPA as it reviews the demonstration that the backstop trading program meets the requirements for an alternative to BART for sulfur dioxide sources.

We are enclosing our technical support documents that provide greater details concerning each of the EGU BART analyses, and request that WY DEQ consider this information before making a final BART determination for Wyoming EGUs.

Once again, we commend WY DEQ for the significant progress its proposals represent. We look forward to working with WY DEQ and EPA as this process advances. We believe that good communication and sharing of information will help expedite this process, and suggest that you contact Don Shepherd (don_shepherd@nps.gov, 303-969-2075) if you have any questions or comments.

Sincerely,

John Bunyak

John Bunyak
Chief, Policy, Planning and Permit Review Branch

Enclosures

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